ASPHALTIC CONCRETE PLANT INSPECTION

GENERAL

The Certified Plant Inspector (ACC Plant Technician) should witness the contractor operations, from the initial plant set up to the final shutdown. The contractor plant and method of operations should be examined thoroughly before work begins. Any deficiencies, which are observed with regard to specification compliance, should be reported to the contractor and the engineer. The Certified Plant Inspector Diary should include all pertinent information regarding the plant, plant set up and calibration, as well as the project data required for contract and specification compliance documentation.

An assistant plant inspector may be assigned to assist in performing the various tests and inspection functions. The overall responsibility for plant inspection remains with the Certified Plant Inspector assigned to the plant. This section deals primarily with this overall responsibility, therefore, no guidelines will be presented regarding division of duties and functions. The assignment of duties and functions of the inspection monitors are the responsibility of the Resident Construction Engineer.

PLANT INSPECTOR DUTIES

A. Preliminary

The first phase of the contractor operations consists of preparing the plant site and building stockpiles. The Certified Plant Inspector should be assigned to the project prior to this phase of the work so that those procedures, which are governed by the specifications, may be observed and properly controlled.

The general areas or procedures requiring attention are:

1. Construction of Stockpiles to:

    a. Minimize segregation
    b. Eliminate contamination and intermingling

    This is accomplished by constructing the stockpile in lifts, controlling stockpile height, controlling drifting and rolling of material, constructing partitions or bulkheads, and stabilizing the stockpile work area. Refer to the specifications for specific requirements.

2. Plant Erection Which Provides:

    a. Safe working conditions

b. Reliable operation

This is accomplished by proper site preparation, placement of adequate foundations for bins and mixing equipment and constructing safeguards such as berms and drainage ways.

B. Job Mix Formula

The job mix formula together with the specifications provide the initial basis for setting up and starting the job, therefore, the plant inspector must be thoroughly familiar with the information provided by the Job Mix Formula Report.

Before the laboratory can develop a job mix formula, the contractor, material producers, and Transportation Center Materials Engineer must make numerous arrangements in the field. The contractor must first select his/her material sources and estimate, in cooperation with the producers, the tentative proportions and gradations of each of the materials. A stockpile of at least 500 Mg (500 tons) or project amount if less must be produced, so that representative samples of the processed material can be obtained. After the contractor has selected the materials, representatives of the Transportation Center Materials Office obtain samples and attempt to combine them as requested by the contractor. Adjustments may be necessary in these proposed proportions since the exact gradations may not be known in advance.

The following example demonstrates how two materials are combined to arrive at a composite gradation:

Gradations of Individual Aggregates-Percent Passing

	25 mm 1 in.	19 ¾ in.	12.5 ½ in.	9.5 ⅜ in.	4.75 #4	2.36 #8	1.18 #16	600 #30	300 #50	150 #100	75 #200
A) 12.5 mm (½ in. Crushed Stone				100	99	80	47	29	21	17	13
11 9.2											
B) Sand				100	96	84	66	42	9.7	1.4	0.7

Example 57.5% Cr. Limestone and 42.5% Sand

Line A x 57.5%	57.5	56.9	46.0	27.0	16.7	12.1	9.8	7.5	6.3	5.3
Line B x 42.5%	42.5	42.5	42.5	40.8	35.7	28.0	17.8	4.1	0.6	0.3
Composite Gradation	100.0	99.4	88.5	67.8	52.4	40.1	27.6	11.6	6.9	5.6

If the composite gradation complies with the limits specified for the job mix formula, production limits are set for the individual aggregates and samples are submitted to the Central or Transportation Center Laboratory for the Job Mix Design Analysis.

Aggregate production and inspection are covered in detail by I.M. 204 and I.M. 209. The acceptance of mixture gradation is outlined in section 3.22 of the Construction Manual, Aggregate Gradation Testing, Sampling & Evaluation.

If the materials as first analyzed do not consistently meet the specified limits, it may be necessary to adjust the proportion percentages or production limits. Familiarity with the material sources and production methods facilitates setting realistic limits. This reduces the number of trial and error steps and subsequent adjustments. It is advantageous to maintain records of this type for each material source and type.

After the preliminary proportions and limits have been established (Refer to page 4.) samples of the aggregates are analyzed in the laboratory to determine the characteristics of the proposed asphalt-aggregate mixture. Certain characteristics are subject to specification limitations. Occasionally changes are required in the material proportions or material sources because mixture characteristics cannot be controlled within the specification limits or design criteria. When changes are made during the design stage, they will be incorporated in the job mix formula report. If changes are found necessary after production begins, they are to be made as provided for in Materials I.M. 511 or I.M. 511 (QMA) unless a complete new job mix formula is required.

A typical Mix Design Report with a description of test results is shown on pages 4 and 5.

FORM 955QMA

IOWA DEPARTMENT OF TRANSPORTATION
PROJECT DEVELOPMENT DIVISION-OFFICE OF MATERIALS
PROPORTIONS & PRODUCTION LIMITS FOR AGGREGATES

COUNTY: HAMILTON PROJECT NO.: FM-40(28)--55-40 DATE: 05/10/99
PROJECT LOCATION: D41
TYPE OF MIX: B CLASS OF MIX: 1 COURSE: BASE(WEARING) MIX SIZE: 1/2"
CONTRACTOR: FRED CARLSON TRAFFIC: 800 A.D.T.

MATERIAL	IDENT #	% IN MIX	PRODUCER & LOCATION
SCRND GRAVEL	A40510	55	BECKER GRAVEL MORTVEDT PIT
1/2"AC STONE	A40006	15	M.M.GRAND GEORGE BEDS 3-5
MAN SAND	A42002	10	M.M.ALDEN BED 3
1/2" CLEAN	A40006	20	M.M.GRAND GEORGE BEDS 3-5

TYPE AND SOURCE OF ASPHALT CEMENT: PG 58-28

INDIVIDUAL AGGREGATES SIEVE ANALYSIS -% PASSING (Target)

MATERIAL	1-1/2	1	3/4	1/2	3/8	4	8	16	30	50	100	200
SCRND GRAVEL	100	100	100	97	93	83	71	58	41	20	8.9	5.6
1/2"AC STONE	100	100	100	97	82	42	21	14	11	9.0	7.7	6.5
MAN SAND	100	100	100	100	100	100	72	37	20	10	5.1	3.8
1/2" CLEAN	100	100	100	94	57	14	5.0	4.5	4.0	3.5	3.0	2.5

PRELIMINARY JOB MIX FORMULA TARGET GRADATION

	1-1/2	1	3/4	1/2	3/8	4	8	16	30	50	100	200
TOLERANCE				92/100	7	7	6		5			3
COMB GRADING	100	100	100	97	85	65	50	39	27	14	7.2	4.9
SURFACE AREA C.	TOTAL					0.02	0.04	0.08	0.14	0.30	0.60	1.60
S.A. SQ. FT./LB.	28.59				+2.0	1.3	2.0	3.1	3.8	4.2	4.3	7.9

PRODUCTION LIMITS FOR AGGREGATES APPROVED BY THE CONTRACTOR & PRODUCER

SIEVE SIZE	55.00% SCRND GRAVEL		15.00% 1/2"AC STONE		10.00% MAN SAND		20.00% 1/2" CLEAN			
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0		
3/4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0		
1/2	90.0	100.0	90.0	100.0	100.0	100.0	87.0	100.0		
3/8	86.0	100.0	75.0	89.0	100.0	100.0	50.0	64.0		
#4	76.0	90.0	35.0	49.0	100.0	100.0	7.0	21.0		
#8	65.0	77.0	15.0	27.0	66.0	78.0	0.0	11.0		
#30	36.0	46.0	6.0	16.0	15.0	25.0	0.0	9.0		
#200	2.6	8.6	3.5	9.5	0.8	6.8	0.0	5.5		

COMMENTS: QMA MIX VERIFICATION.FINAL APPROVAL BASED UPON PLANTPRODUCED MIX. ALSO FOR FM-40(29)--55-40,FM-40(30)--55-40, STP-S-40(31)--5E-40,L-F99(1)--73-40 APPROX 37,000 TONS

The above target gradations and production limits have been discussed with and agreed to by an authorized representative of the aggregate producer.

Signed______________________________ Signed__________________________________
Producer Contractor

IOWA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS
ASPHALT CONCRETE MIX DESIGN
LAB LOCATION C.I.T.C.

MATERIAL: TYPE B CLASS 1
INTENDED USE: BASE(WEARING)
SIZE: 1/2 in. SPEC. NO.:
COUNTY: HAMILTON
CONTRACTOR: FRED CARLSON
PROJ. LOCATION: D41

LAB NO.: 1bd9-010
CONTRACT NUMBER:
DATE REPORTED: 05-10-1999
PROJECT: FM-40(28)--55-40
ADT: 800

AG. SOURCES: SCRND GRAVEL-BECKER GRAVEL MORTVEDT PIT @ 55%
1/2"AC STONE-M.M.GRAND GEORGE BEDS 3-5 @ 15%
MAN SAND-M.M.ALDEN BED 3 @ 10%
1/2" CLEAN-M.M.GRAND GEORGE BEDS 3-5 @ 20%

JOB MIX FORMULA-COMBINED GRADATION

	1-1/2	1	3/4	1/2	3/8	#4	#8	#16	#30	#50	#100	#200
	100	100	100	97	85	65	50	39	27	14	7.2	4.9
TOLERANCE				92/100	7	7	6		5			3

ASPHALT SOURCE AND GRADE: PG 58-28

% ASPHALT IN MIX	5.00	5.86	6.00	7.00
NUMBER OF MARSHALL BLOWS	50	50	50	50
MARSHALL STABILITY LBS.	2733	2733	2733	2733
FLOW - 0.01 IN.	8	8	8	8
MARSHALL SP GR-LAB DENS.	2.333	2.355	2.359	2.362
BULK SP GR COMBINED AGGR	2.577	2.577	2.577	2.577
SP. GR. ASPHALT @ 77 F	1.030	1.030	1.030	1.030
CALC. MAX. SP. GR.	2.459	2.428	2.423	2.396
CALCULATED % VOIDS	5.12	3.00	2.64	1.42
MAX. SP. GR. - RICE	2.459	2.428	2.423	2.396
% VOIDS - RICE	5.12	3.00	2.64	1.42
% WATER ABSORPTION AGGR	1.90	1.90	1.90	1.90
% VOIDS IN MINERAL AGGR	13.99	13.96	13.95	14.76
% V.M.A. FILLED WITH AC	63.39	78.51	81.07	90.39
FILM THICKNESS-MICRONS	6.68	8.17	8.42	9.92
FILLER/BITUMEN RATIO	0.98	0.84	0.82	0.70
EFFECTIVE SP GR - AGGR	2.653	2.655	2.652	2.662
CALC. % AC ABSORPTION	1.14	1.18	1.13	1.27
CALC. BULK SP. GR.-AGGR.	2.589	2.592	2.589	2.598

MINIMUM %AC FOR THIS AGGREGATE COMBINATION IS 5.69%

DISPOSITION: AN ASPHALT CONTENT OF 5.9% IS RECOMMENDED TO START THE JOB

COMMENTS: QMA MIX VERIFICATION. FINAL APPROVAL BASED ON PLANT PRODUCED MIX.

RESULTS SHOWN IN 5.86 COLUMN ARE INTERPOLATED FROM TEST DATA.

COPIES TO: CENTRAL LAB FRED CARLSON CITC MATERIALS
CITC LAB TRUEBLOOD HAMILTON CO.

SIGNED: JOHN VU
ENGINEER

ASPHALT CONCRETE MIX DESIGN

Refer to:

Section A. Project Information.

Line B. Job mix formula aggregate proportions set as specified. Aggregates listed by laboratory number in sequence as identified on source line in Section A.

Line C. Job mix formula target and design gradation with tolerances.

Line D. Source and grade of the asphalt used in the job mix formula.

Line E. Asphalt percentages used to establish asphalt content for formula.

Line F. Marshall Stability and Flow Test data, refer to I.M. 511 for recommended minimum stability values.

Line G. The specific gravity by displacement of the 63.5 mm by 102 mm (2½ by 4 in.) specimens before being tested for stability. The specimens are compacted in a mold by a mechanical Marshall Compactor. These laboratory density values are used to compute void percentages line K, per I.M. 510.

Line H. The bulk specific gravity of the combined aggregate used in the trial mixtures.

Line I. The specific gravity of the asphalt used in the laboratory trial mixtures.

Refer to Materials* I.M. 510 *for method of measurement and calculation of results shown in lines J, K, M and N.

Line J. Rice Specific Gravity as determined per I.M. 350.

Line K. The percent air voids in the compacted specimens.

Line L. The percent by weight of water absorption for the combined aggregate used in these trial mixtures.

Line M. The voids in the mineral aggregate expressed as percent of the bulk volume of the compacted mixture. This void space is defined as the intergranular void space between the particles of aggregate in a compacted mixture.

Line N. Average asphalt coating film thickness, the ratio of effective asphalt, adjusted for absorption, to the aggregate surface area as determined from the job mix formula gradation.

Line O. The ratio between the -75 µm (-200) material and the asphalt cement.

Line P. The target asphalt content recommended to start mixture production. Expressed as a percent of asphalt cement, based on the total mass of the mixture. Established during the mixture design process.

C. Sampling and Testing

There are a number of sampling and testing procedures that a plant inspector must be familiar with and perform in order to establish and maintain acceptable quality construction. A number of these tests, measurements, and calculations, in addition to documenting specification compliance, also provide the basis for determining contract pay quantities.

Sampling frequencies are provided for in I.M. 204 and the Standard Specifications.

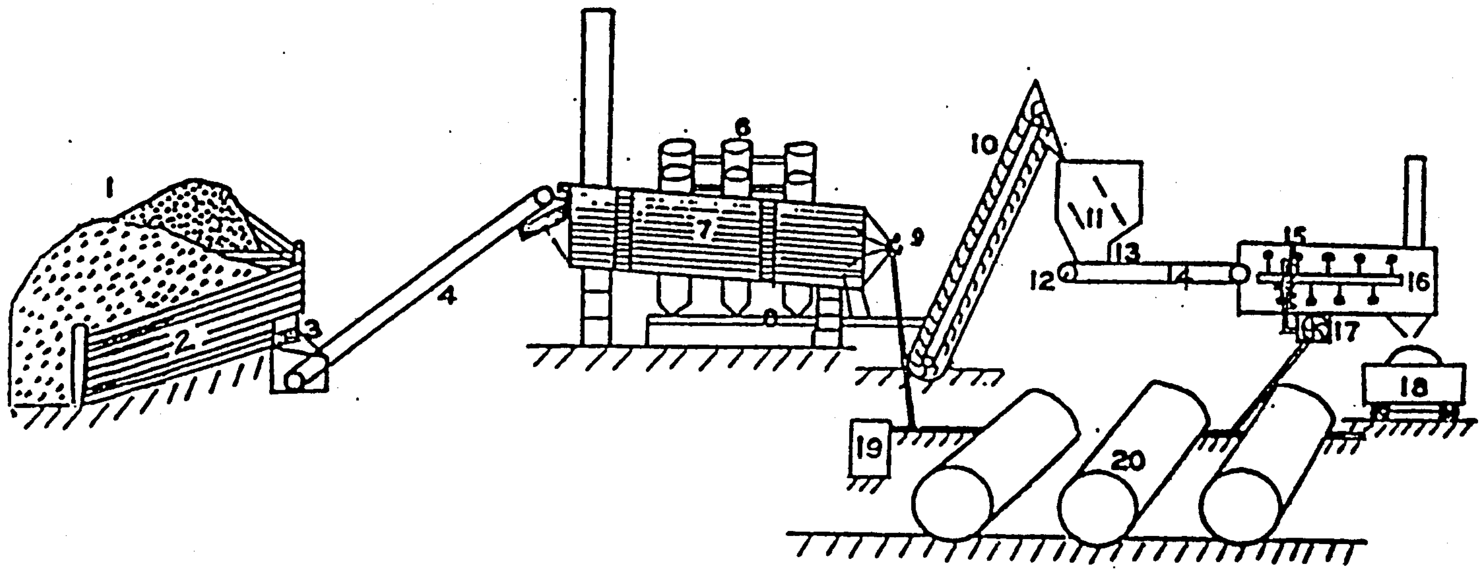
Sampling and testing methods are provided for in I.M. 300 series. Each of the measurements and tests, which are the responsibility of the plant inspector, are discussed in subsequent sections of this instruction.

D. Plant Equipment

Items of equipment to be checked for specification compliance prior to beginning operations are listed below:

1. Truck Scales
2. Cold Aggregate Feeders
3. Dryer
4. Dust Collector and Feeder
5. Hot Aggregate Storage Bins and Feeders
6. Revolution Counters, and/or Scales
7. Thermometer Equipment.
8. Equipment for Heating, Storing and Measuring Asphalt Cement
9. Asphalt Pump, Surge Tank, and/or Scales
10. Testing Laboratory
11. Safety Requirements

Refer to the following plant diagrams and descriptions.

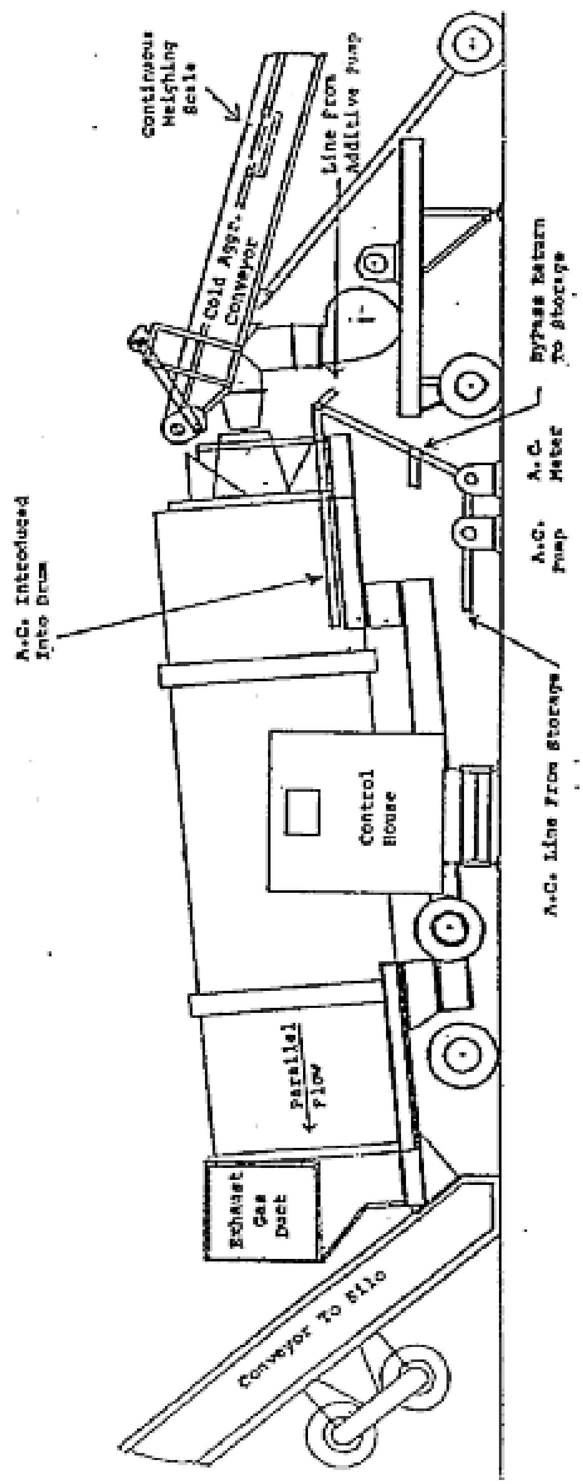


CONTINUOUS PLANT

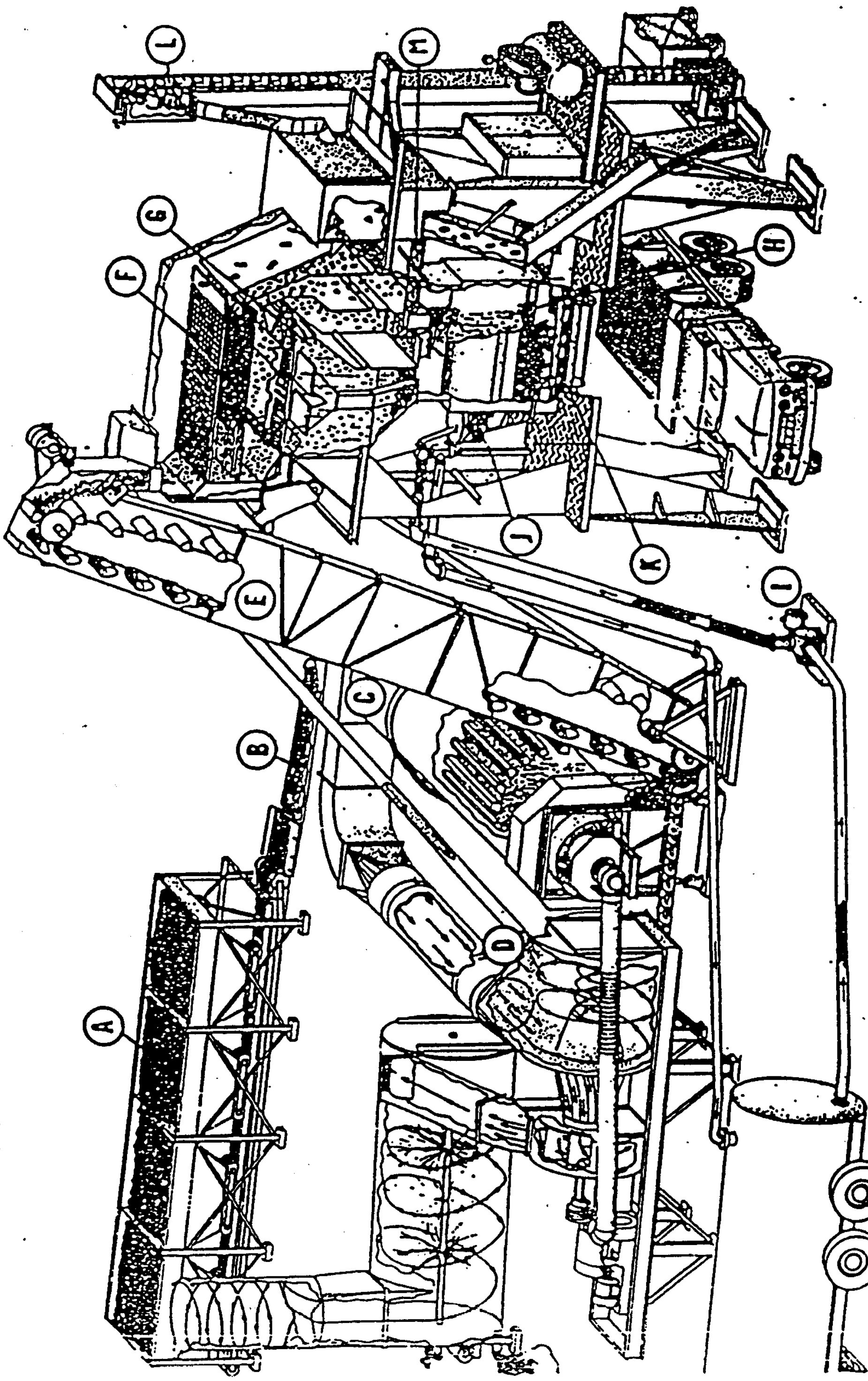
Material Flow Diagram

1. Aggregate Stockpiles
2. Separating Bulkheads
3. Proportioning Feeder
4. Cold Aggregate Conveyor
5. Dryer Intake, Screen
6. Dust Collector
7. Dryer Drum
8. Dust Return
9. Burner
10. Hot Aggregate Elevator
11. Hot Aggregate Storage Bin
12. Approximate Location of Revolution Counter
13. Bin Gate Control
14. Feeder Belt
15. Asphalt Spray Bars
16. Mixer and Holding Hopper
17. Asphalt Pump
18. Truck Position
19. Fuel Line to Burner
20. Asphalt Storage Tanks

DRIER DRUM MIXER



BATCH PLANT



BATCH PLANT MATERIAL FLOW DIAGRAM

A. Multiple Compartment Cold-feeder
B. Cold Elevator
C. Drier
D. Horizontal Cyclone Dust Collector & Exhaust Washer
E. Return Hot Aggregate Elevator & Dust
F. Screening Unit
G. Hot Aggregate Storage Bins
H. Aggregate Batcher & Scale
I. Asphalt Transfer Pump
J. Asphalt Batcher & Scale
K. Pugmill Mixer
L. Optional Mineral Filler Elevator
M. Optional Mineral Filler Feeder

E. Plant Calibration

The specifications require that all material proportioning equipment be calibrated and checked for accuracy. The job mix formula provides the basis for the calibrations.

When specifications require the contractor to provide personnel, scales, test weights, and equipment for calibrating each delivery component, the plant inspector shall determine moisture contents of the various materials. Use the formula;

$$\% \text{ moisture} = \frac{\text{wet mass - dry mass}}{\text{dry mass}}$$

The plant calibration will be monitored by and subject to the approval of the Transportation Center Materials Engineer or authorized representative. The plant inspector should be present and observe all procedures. The Transportation Center Materials Engineer will furnish the plant inspector with copies of the calibration results, so adequate information is available for making adjustments when indicated. Should difficulty be experienced during plant calibrations, the Transportation Center Materials Engineer should be contacted for assistance. Normally, the Transportation Center Materials Engineer will assign one or more experienced inspectors to monitor the calibration of proportioning and mixing plants. The plant inspector should be thoroughly acquainted with plant operations, so problems are recognized and corrected as early as possible.

A sample calibration has been included as a guide in this section (pages 19 to 30). Due to the wide variation in plant equipment, this example will not cover all situations, but it should provide the basis for understanding the overall procedure.

1. Cold Aggregate Feeders

The first step in calibrating a proportioning plant is the calibration of the cold aggregate feeders. These units determine the final gradation of the mixture.

a. Fixed Speed-Variable Gate Opening Cold-feeders

These feeders are controlled by gates which meter the flow volumetrically. They are calibrated by weighing the quantity of material which passes through a given gate opening during a measured time interval. The interval is determined by counting the number of revolutions that the feeder makes while the material is delivered. From the RPM of the feeder and the mass (weight) of the material, the deliver rate in kg (pounds) per minute is calculated (corrected for moisture). The calibration is graphed by plotting the kg (pounds) of dry aggregate delivered per minute at the gate openings used in the calibration.

b. Fixed Gate Opening-Variable Speed Cold-feeders

With this system, a gate opening is selected for each cold-feeder. This gate opening must be maintained throughout the calibration and the job. They are calibrated by weighing the amount of material delivered at several different speeds of the cold-feeder motor over a measured time interval.

The calibration is graphed by plotting the kg (pounds) of dry aggregate delivered per minute at the speeds of the cold-feeder motor used in the calibration.

These cold-feeders are equipped with a master control, which may be used to adjust the production rate. Changing the master control setting changes the speed of all the cold-feeders proportionately.

c. With either type of cold-feed, the gate setting is very important and should be checked regularly.

d. Refer to the example calibration forms included on pages 19 to 28.

2. Conveyor Scales

The specifications require Drier Drum Mixing Plants be equipped with continuous weighing central conveyor scales that are interlocked with the asphalt deliver system. These scales are checked for accuracy by two methods as follows:

a. The scale is first zeroed while the conveyor is operating at normal operating speed, but unloaded. It is then adjusted to readout a predetermined total mass (weight) using the special scale beam weights and a standard operating time interval. Both of the foregoing procedures are to be performed in accordance with the scale manufacturer's instructions.

b. The second accuracy check requires the comparison of the mass (weight) shown on the totalizing meter, with the mass (weight) actually delivered as determined by running material over the conveyor into a tared truck. The truck tare and loaded weights must be obtained by weighings over certified commercial truck scales, or plant scales that have been checked against certified scales and approved by the Engineer. The conveyor scales should be checked at several delivery rates representing the proposed operating range. The contractor shall adjust the weighing system so that when the plant is operating, the final mixture is uniform and consistently within the specified job mix formula tolerances.

3. Asphalt Pump

Some batch plants, all continuous and drum mixing plants deliver asphalt material to the mixer through volumetric pumps. The pumps are adjusted by changing drive sprockets or movement of a vernier dial control. These volumetric systems must be calibrated throughout the proposed operating range at the normal operating temperature. When totalizing meters are required, they must be adjusted to readout the quantity delivered within the specified deliver tolerance.

If the contractor elects to use in-line flow meter readings for pay, the meter must be accurate to plus or minus 0.2% as demonstrated through the calibrations process. If this degree of accuracy cannot be attained, measurement for pay shall still be by tank stick.

When a flow meter is used for pay, yield checks will be performed in accordance with Construction Manual procedures.

4. Hot Aggregate Feeders

After the various aggregates have been proportioned and dried, they are fed to the mixer unit in one of two ways:

a. On continuous flow plants the hot aggregate is fed through adjustable calibrated gates to the mixer by elevator or belt. These feeders are calibrated in the same manner that cold-feeders are calibrated, but in relation to the plant revolution counter. Refer to examples on pages 26, 27, and 28.

b. On batch plants the hot aggregates are weighed in batches over calibrated scales as described in the following paragraphs and examples.

The dust collected by the dust collector is fed from a calibrated bin or returned directly to the hot aggregate, depending on the type of plant equipment and the specification requirements. If the dust is returned separately, the feeder should be calibrated to feed the required quantity of dust in a uniform manner. If the dust is returned directly to the hot aggregate the weight or volume of dust collected and returned is taken into account automatically in the calibration of the hot aggregate delivery system or batch weights.

If the plant is equipped with gradation units, they should be balanced, to deliver material, which has a gradation similar to the composite gradation being delivered by the cold-feed system.

5. Batch Plant Scales

Calibration of batch plant scales as required by the specifications is performed by incrementally loading the scales with standard test weights and partial batches through the operating range of the scales (page 21). As each increment of load is applied, the actual observed weight and the required weight are compared. The differences, plus or minus, are determined and converted to percentages of the required weight. If the percentage deviations are less than the tolerance allowed by the specifications and the scales are sensitive to the test loads, the scales will be considered in calibration. If the scales do not meet the various requirements, the contractor should be notified immediately and required to make the necessary repairs or adjustments. Recalibration may be ordered by the engineer if the scale equipment malfunctions or if required material quantities do not agree with actual material quantities.

6. Initial Plant Settings

Three examples of initial plant settings have been provided: one for a drum mix plant, one for a 1,361 kg (3000 pound) batch plant with a volumetric asphalt measurement, and one for a continuous plant with a sprocket type asphalt pump.

The plant inspector is at this point cautioned not to make adjustments or effect settings of plant equipment, and in no way manipulate or operate any equipment at any time. All operations connected with the contractor plant or other equipment are by specification the strict and total responsibility of the contractor.

7. Mixing Rate

The specifications contain requirements regarding the quality and duration of mixing for the various types of mixes and plants. The design, condition, speed and loading of the mixer unit together with the characteristics of the materials being mixed will vary from job to job and need to be taken into account when evaluations are made.

Mixing times are determined in the following manner:

a. Continuous Plants. Mixing time in a continuous plant is the interval between the entrance of the aggregate into the mixer and the discharge of the same aggregate, coated with asphalt, from the mixing chamber. The mixing time, in seconds, is determined by the following formula:

$$\frac{\text{Pugmill Content[kg.(lbs.)]}}{\text{Pugmill Output [kg.(lbs.)per second]}} = \text{(Mixing Time Seconds)}$$

The pugmill content in Mg (lbs.) is determined under operating conditions by stopping the mixer, emptying hopper, cutting off the feed and running the material in the mixer into a separate truck to be weighed. The weight of the material adhering to the walls and paddles of the mixer is estimated and added to the quantity in the truck. The pugmill output equals the pugmill input and is determined from the bitumen pump and hot aggregate calibration data. Mixing times may be increased by:

1. Reversing the mixer paddles to retard the flow of material through the mixer

2. Reducing the material input rate

3. Raising the dam gate at the end of the mixer

b. Batch Plants. The mixing rate of batch plants is controlled by the batch size and the dry and wet mixing timer settings. The batch size should not exceed the manufacturers rated capacity and the timer should be set to provide the specified mixing time unless more or less time is authorized by the engineer. The accuracy of the timer may be checked with a stopwatch if necessary.

Form 821916
3-86

Iowa Department of Transportation
CALIBRATION OF PLANT EQUIPMENT
Cold Feed and Asphalt Cement Delivery
(Continuous - Batch - Drum)

County Tama
Project FR-30-6(44)--26-86
Date 8-4-96
Proj. Eng. John Peters

Contractor Cessford Const. Plant Location Montour Quarry Material Ident. & % 3/4" Cr. Lmst 58% Moisture 2.6 %
Plant Type and Name Cedar Rapids - Drum Mix Pollution Control ______ Material Ident. & % Sand 30% Moisture 4.0 %
Mix Type B Binder Recycled Class I ADM-1 Mix Size 3/4" Gate ______ Material Ident. & % RAP 12% Moisture 5.1 %
Asphalt Type and Grade AC-10 Temperature °F ______ RPM Feeder/RPM Plant/Master Maximum Plant Set for 300 TPH

Bin Number	#1 SAND			#2 and 3			3/4" Cr. Lmst.			#5 R.A.P.		
~~Pump vernier setting/gate opening in inches~~/Dial setting	Dial - 8.2			Dial - 5.9			Dial - 5.9			Dial - 6.1		
Run number	1	2	3	1	2	3	1	2	3	1	2	3
Revolutions delivered/Time delivered												
Total wet weight aggregate delivered/TPH wet	93.6			178.5 →						37.8		
Total weight A.C. delivered Total dry weight aggregate delivered/TPH Dry	90.0			174.0 →						36.0		
Dry weight per revolution												
Dry weight per minute												
~~Average dry weight per (Minute Rev.)~~/Tach set point	88.0			48.0			23.0			79.0		
	Gate 6"			Gate 6"			Gate 6"			Gate 4"		

Date scale was certified 8-4-86

The above data is furnished as set forth in the Standard Specifications for plant operations, for informational purposes only. The Contracting Authority makes no representations as to accuracy, either expressed or implied, which are to be construed to relieve the Contractor from the responsibility to comply with the specifications.

Calibrated by Theodore Huisman (Name) Monitored by Mark Trueblood (Name)
Contractor Cessford Construction Title Asphalt Tech - Dist Materials

Distribution:
White Copy - Plant Inspector
Canary Copy - C[illegible]actor
Pink Copy - Di[illegible] [illegible]aterials Engineer
Goldenrod Copy - [illegible]roject Engineer

Form 820015
3-86

CALIBRATION OF PLANT EQUIPMENT
(DRUM MIX PLANT)

County Tama
Project FR-30-6(44)--26-86
Date 8-4-88
P.oj. Eng. Tom Reis

Contractor Cessford Construction Plant Location Montour Quarry
Plant Type and Name Cedar Rapids Drum Mix Pollution Control Baghouse
Mix Type A Surface Class ______ Mix Size 3/4"
Asphalt Type and Grade AC-10 Temperature °F ______ A.C. #/Gal. 8.55

WEIGHT BELT			
Run Number	1	2	3
Span	2541	2578	2578
Fine Zero	5524	5524	5524
Total weight aggregate lbs.	17,640	17,460	17,500
Truck total weight aggregate lbs.	17,900	17,440	17,490
Difference	-260	+20	+10
% Error	1.45	0.10	0.06

A.C. PUMP			
Run Number	1	2	3
Meter Er. Gals.	299	300	
Corrected Gals.			
Metered lbs.	2556	2565	
Truck lbs.	2560	2568	
Difference	-4	-3	
% Error	0.16	0.12	

WEIGHT SILO			
Run Number	1	2	3
Total weight lbs.	28160	28500	
Truck lbs.	28180	28510	
Difference	-20	-10	
% Error	0.07	0.04	

Date scale was certified 8-4-88
Sensitivity check on weightsilo
was O.K.

The above data is furnished as set forth in the Standard Specifications for plant operations, for informational purposes only. The Contracting Authority makes no representations as to accuracy, either expressed or implied, which are to be construed to relieve the Contractor from the responsibility to comply with the specifications.

Calibrated by Ted Huisman (Name) Witnessed by Mark Trueblood (Name)
Contractor Cessford Construction Title Asphalt Tech-District I Materials

Distribution:
White Copy - Plant Inspector
Canary Copy - Contractor
Pink Copy - District Materials Engineer
Goldenrod Copy - Project Engineer

ASPHALTIC CONCRETE
BATCH PLANT

PROJECT: IIST-9-B (16)--4A-96
TYPE: A Surface
CONTRACTOR: Fred Carlson

INTENDED A.C.= 5.5 %

SIZE OF BATCH:	AGGREGATE:	ASPHALT:

Used 1200# of Weights

ASPHALT SCALE

APPLIED LOAD	RUN:	#1	#2	#3	#4

Note: Do to midrange scale error no batches below 2400 lbs will be allowed!!

SRe #

SR # @ #

AGGREGATE SCALE

APPLIED LOAD	RUN:	#1	#2	#3	#4
			Acc. Error		
150		✓			
300		✓			
450		+3			
600		+2			
750		+1½			
900		✓			
1050		✓			
1200		-1½	-1½		
1350		-1½			
1500		-7½			
1650		-7			
1800		-7			
1950		-7½			
2100		-6			
2250		-6			
2400		-3	-4½		
2550		-3			
2700		+2			
2850		+4			
3000		✓	-4½		

SRe OK 1 #

SR 1 # @ 3000 # OK

/s/ [signature] DATE 6-7-88
witnessed by Mark Pickett ACI

Iowa Department of Transportation
CALIBRATION OF PLANT EQUIPMENT
Cold Feed and Asphalt Cement Delivery
(Continuous - Batch - Drum)

County Winn
Project UST-9-B(10) ... -96
6-7-88
Proj. Eng. Erdman

Contractor Fred Carlson Co. Plant Location Decorah Pit Material Ident. & % Oil Moisture ___ %
Plant Type and Name H+B Pollution Control Bag House Material Ident. & % ___ Moisture ___ %
Mix Type A Class Surface Mix Size 1/2 Gate ___ Material Ident. & % ___ Moisture ___ %
Asphalt Type and Grade Koch AC-10 Temperature °F ___ ~~RPM Feeder/RPM Plant/Master~~ ___ Plant Set for ___ TPH

Bin Number	Oil			Oil			Oil			Oil		
Pump vernier setting/gate opening in inches/Dial setting	15			25			25			30		
Run number	1	2	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
~~Revolutions delivered/Time delivered~~ Gross	148.5	155.5		226.5	233.5	226	234			215	273	266
~~Total wet weight aggregate delivered/TPH wet~~ Tare	42.5	50		50	53	52	55			54.5	53.5	52.5
~~Total weight A.C. delivered~~ Total ~~dry weight aggregate delivered/TPH Dry~~ Net	106.0	105.5		176.5	180.5	174	179			217	218.5	213.5
~~Dry weight per revolution~~												
~~Dry weight per minute~~												
Average dry weight per (Minute-Rev.)/Tach set point	105.75			177.5						216.7		

+3.5 Scale Error
181.0

Date scale was certified July 27 87

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Distribution:
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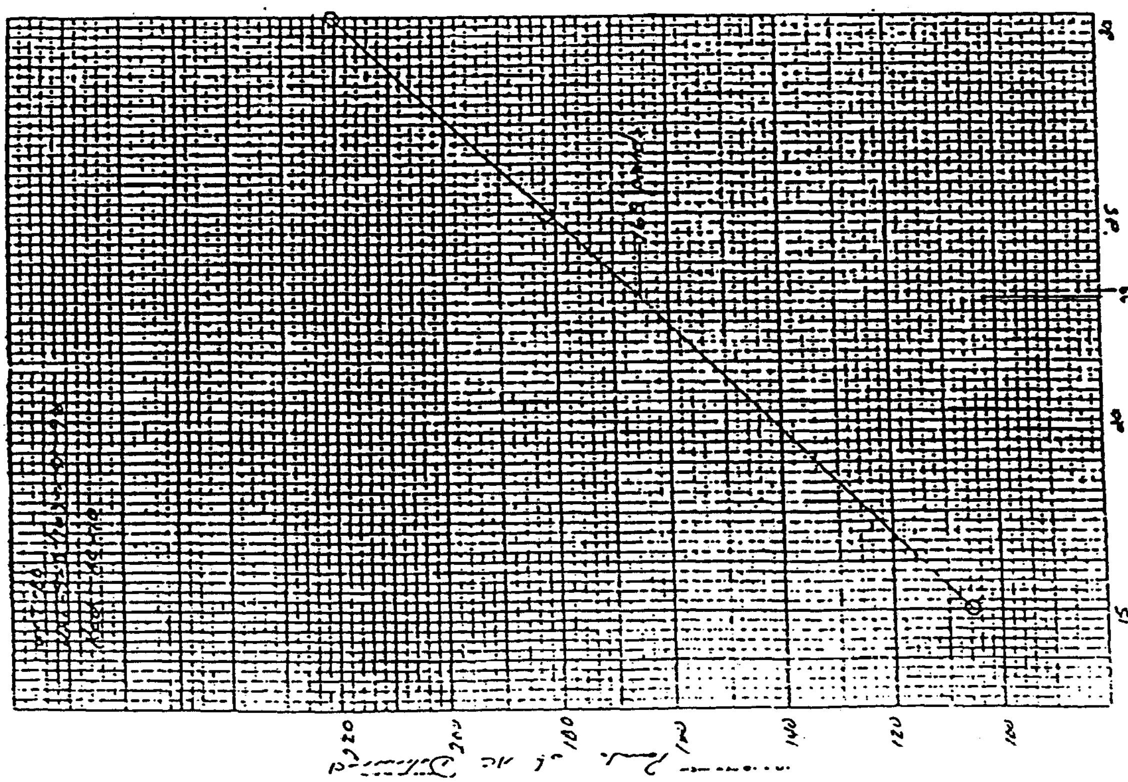
Pink Copy - District Materials Engineer
Goldenrod Copy - Project Engineer

Calibrated by [illegible] Witnessed by [illegible]
Contractor ___ Title A.C. Tech



Iowa Department of Transportation
CALIBRATION OF PLANT EQUIPMENT
Cold Feed and Asphalt Cement Delivery
(Continuous - Batch - Drum)

County: Winneshiek
Project: UST-9-8(16)--4A-96
Contract No.:
Date: 6-7-88
Proj. Eng.: Erdman

Contractor: Fred Carlson Co. Plant Location: Decorah Pit Material ID: Lmst. & % 60 Moisture 4.2 %
Plant Type and Name: H & B Pollution Control: Bag House Material ID: & % Moisture %
Mix Type: A Class: Surface Mix Size: 1/2" Material ID: & % Moisture %
Asphalt Type and Grade: Koch AC-10 RPM Feeder/RPM Plant/Master: 20.1 Plant Set For: mg/hr (TPH) Material ID: & % Moisture %

Bin Number Material ID	2			2			2					
Pump vernier setting/gate opening in mm(in)Dial setting	3"			4"			5"					
Run number												
Revolutions delivered/Time delivered	80.7	81.1		81.2	81.2		81.8	81.2				
Total wet mass(wt.) aggregate delivered mg/hr (TPH) wet	4760	4740		6450	6520		8670	8660				
~~Total weight A.C. delivered~~ Total dry mass(wt.) aggregate delivered Dry	4568	4549		6190	6257		8321	8311				
Dry mass (wt.) aggregate per revolution	56.6	56.1		76.2	77.1		102.3	102.4				
Dry mass (wt.) aggregate per minute	1138	1127		1532	1549		2057	2057				
Average dry mass (wt.) agg. per (Minute-Rev.)/Tach set point	1132.5			1540.5			2057					

Date scale was certified: Sept. 27, 87

The above data is furnished as set forth in the Standard Specifications for plant operations, for informational purposes only. The Contracting Authority makes no representations as to accuracy, either expressed or implied, which are to be construed to relieve the Contractor from the responsibility to comply with the specifications.

Calibrated by: Mike [illegible] Witnessed by: Mark [illegible]
Contractor: Title: A.C. Tech

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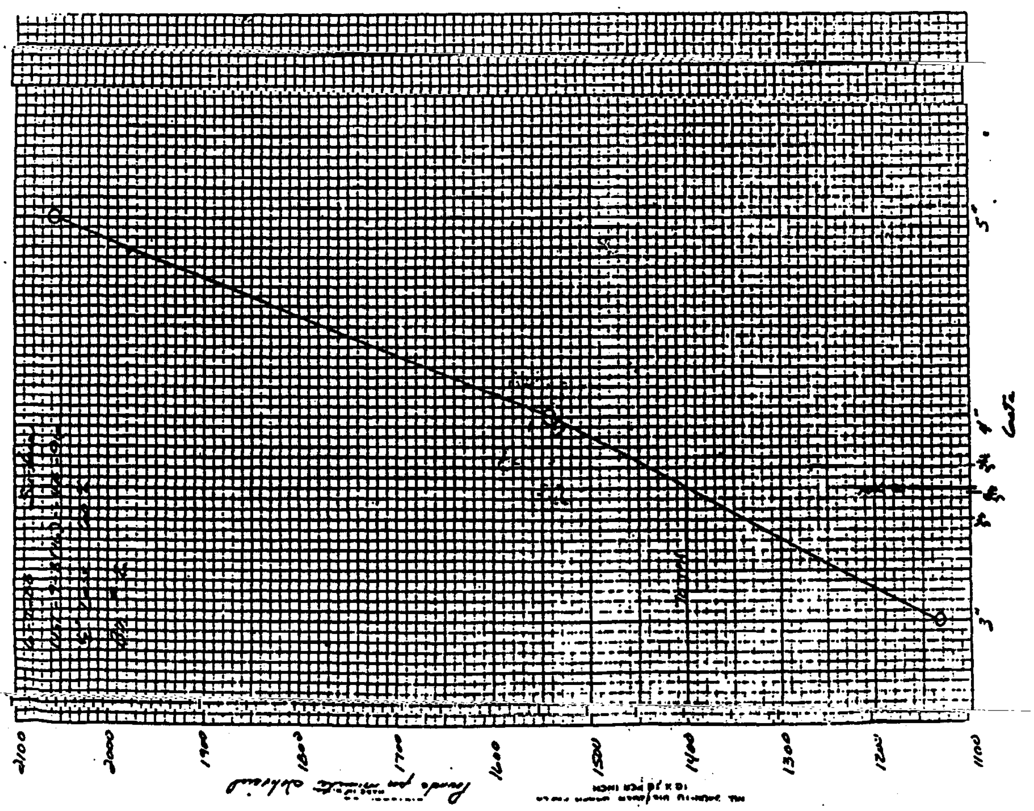

Iowa Department of Transportation
CALIBRATION OF PLANT EQUIPMENT
Cold Feed and Asphalt Cement Delivery
(Continuous - Batch - Drum)

County Winn
Project UST-9-8(6) 1-4A96
Date 6-7-83
Proj. Eng. Edwards

Contractor Fred Carlson Co. Plant Location Decorah Pit Material Ident. & % Sand 40% Moisture 3.1 %
Plant Type and Name H&B Pollution Control Baghouse Material Ident. & % ______ Moisture ______ %
Mix Type ______ Class A Mix Size ______ Gate ______ Material Ident. & % ______ Moisture ______ %
Asphalt Type and Grade Koch AC-10 5.5% Temperature °F ______ RPM Feeder/RPM Plant/Master 20.8 Plant Set for ______ TPH

Bin Number										
Pump vernier setting/gate opening in inches/Dial setting	2"			3"		4"				
Run number	1	2								
Revolutions delivered/Time delivered	631	63.1		630	633	634	633			
Total wet weight aggregate delivered/TPH wet	2740	2750		4020	4080	5400	5380			
~~Total weight A.C. delivered~~ Total dry weight aggregate delivered/TPH Dry	2658	2665		3899	3899	5238	5218			
Dry weight per revolution	42.1	42.3		61.9	61.6	82.6	82.4			
Dry weight per minute	876	879		1287	1281	1718	1715			
Average dry weight per (Minute-Rev.)/Tach set point	877.5			1284		1716.5				

Date scale was certified Sept. 27, 82

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Distribution:
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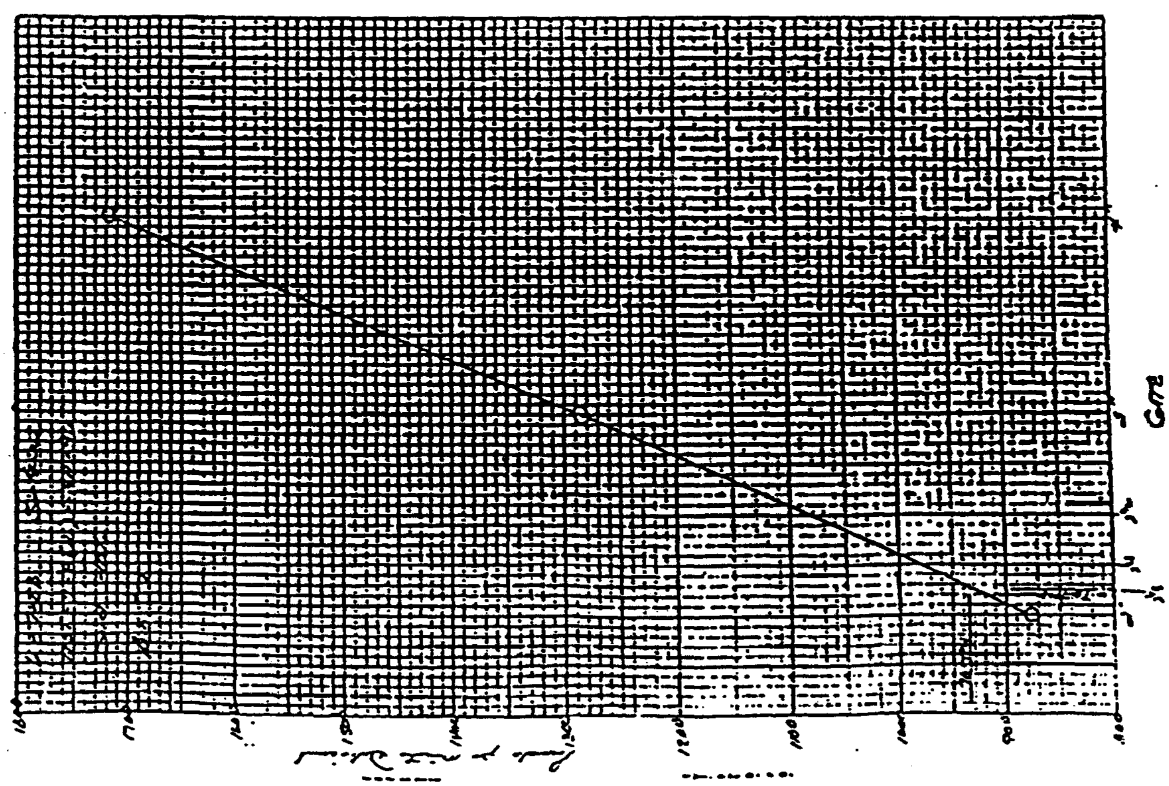
Goldenrod Copy - Project Engineer

Calibrated by [illegible] Witnessed by [illegible]
Contractor ______ Title AC [illegible]



ASPHALTIC CONCRETE
HOT-MIXED
HOT FEED & A.C. PUMP CALCULATIONS (Continuous Plant)

SPROCKET DRIVE A.C. PUMP

PROJECT:	12-35-2(21) 203--12-98
TYPE:	3/4 Type B
CONTRACTOR:	Manatts Sub: Tuttle Asphalt

INTENDED A.C. = 5.1 %

AGGREGATE = 94.9 %

SPROCKET SIZE = 34 X 35 = #/REV.

PLANT = 11.0 RPM

AC #/REV / %AC	7.95 / .051
#MIX/REV	155.88
TPH MIX	51.44
TPH AC	2.62
#Mix/Rev -#AC/Rev HOT AGG/REV	155.88 — 7.95 147.93
TPH HOT AGG	48.82

w/ mod. /s/ Mark Field Date 7-29-87

Iowa Department of Transportation
CALIBRATION OF PLANT EQUIPMENT
Cold Feed and Asphalt Cement Delivery
(Continuous - Batch - Drum)

County ____
Project IR-35-8(21)-203-12-98
Contract No. ____
Date 7-29-87
Proj. Eng. Sommers

Contractor Tuttle Asph. & Bros. Inc. Plant Location Basic Materials - Worth Co. Material Ident. & % ____ Moisture ____ %
Plant Type and Name B/G Cedar Pollution Control Scrubber Material Ident. & % ____ Moisture ____ %
Mix Type B Class ____ Mix Size 3/4" Gate Hot Gate Material Ident. & % ____ Moisture ____ %
Asphalt Type and Grade AC-10 Temperature °F ____ RPM Feeder/RPM Plant/Master 11.0 Plant Set for ____ TPH

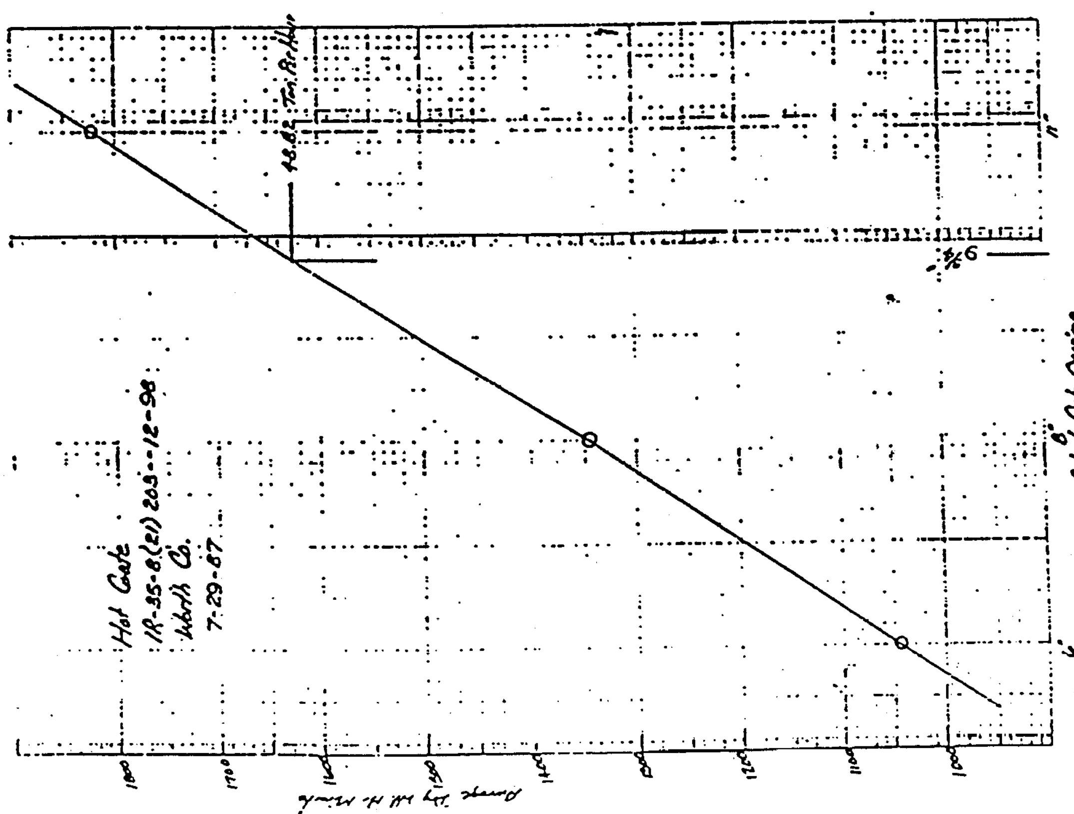
Bin Number												
Pump vernier setting/gate opening in inches/Dial setting	6"			8"			11"			Oil Pump Calib. Sprocket 21x35		
Run number	1	2	3	1	2	3	1	2	3	1	2	3
Revolutions delivered/Time delivered	60	61		60	62		55	54	54	91	165	
Total wet weight aggregate delivered/TPH wet												
Total weight A.C. delivered / Total dry weight aggregate delivered/TPH Dry	5760	5740		7380	7560		9062	9158	6824	736	1289	
Dry weight per revolution	96.0	94.1		123.0	121.9		164.4	169.6	163.6	8.09	7.81	
Dry weight per minute	1056	1035		1353	1341		1808	1866	1797			
Average dry weight per (Minute-Rev.)/Tach set point	1045.5			1347			1824			7.95		

Date scale was certified May 13, 1987

The above data is furnished as set forth in the Standard Specifications for plant operations, for informational purposes only. The Contracting Authority makes no representations as to accuracy, either expressed or implied, which are to be construed to relieve the Contractor from the responsibility to comply with the specifications.

Calibrated by Terry West Witnessed by Mark ____
Contractor Tuttle Asph. & Bros. Inc. Title P.C. Tech.

Distribution: White Copy - Plant Inspector; Canary Copy - Contractor; Pink Copy - District Materials Engineer; Goldenrod Copy - Project Engineer



Iowa Department of Transportation
CALIBRATION OF PLANT EQUIPMENT
Cold Feed and Asphalt Cement Delivery
(Continuous - Batch - Drum)

County: Worth
Project: IR-35-8(21)203-12-98
Contract No.: 27271
Date: 7-29-87
Proj. Eng.: Summers

Contractor: Tuttle Asphalt & Paving Inc. Plant Location: Basic Mats. - Fertile Co. Material Ident. & %: 75% Limest. Moisture: ±1.0 %
Plant Type and Name: B/G Cont. Pollution Control: Scrubber Material Ident. & %: ______ Moisture: ____ %
Mix Type: B Class: ______ Mix Size: 3/4" Gate: See Below Material Ident. & %: ______ Moisture: ____ %
Asphalt Type and Grade: AC-10 Temperature °F: ______ RPM Feeder/RPM Plant/Master: 28.5 Plant Set for: ____ TPH

Bin Number	9			3			3					
Pump vernier setting/gate opening in inches/Dial setting	2"			2½"			3"					
Run number	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2	[illegible]	[illegible]	[illegible]	[illegible]
Revolutions delivered/Time delivered	163	165		127	130		127	128				
Total wet weight aggregate delivered/TPH wet	3960	4000		4960	5080		6560	6820				
Total weight A.C. delivered Total dry weight aggregate delivered/TPH Dry	3841	3980		4811	4927		6363	6615				
Dry weight per revolution	23.56	23.51		37.88	37.90		50.10	51.68				
Dry weight per minute	667	665		1072	1073		1418	1462				
Average dry weight per (Minute-Rev.)/Tach set point	666			1072.5			1440					

Date scale was certified: May 13, 1987

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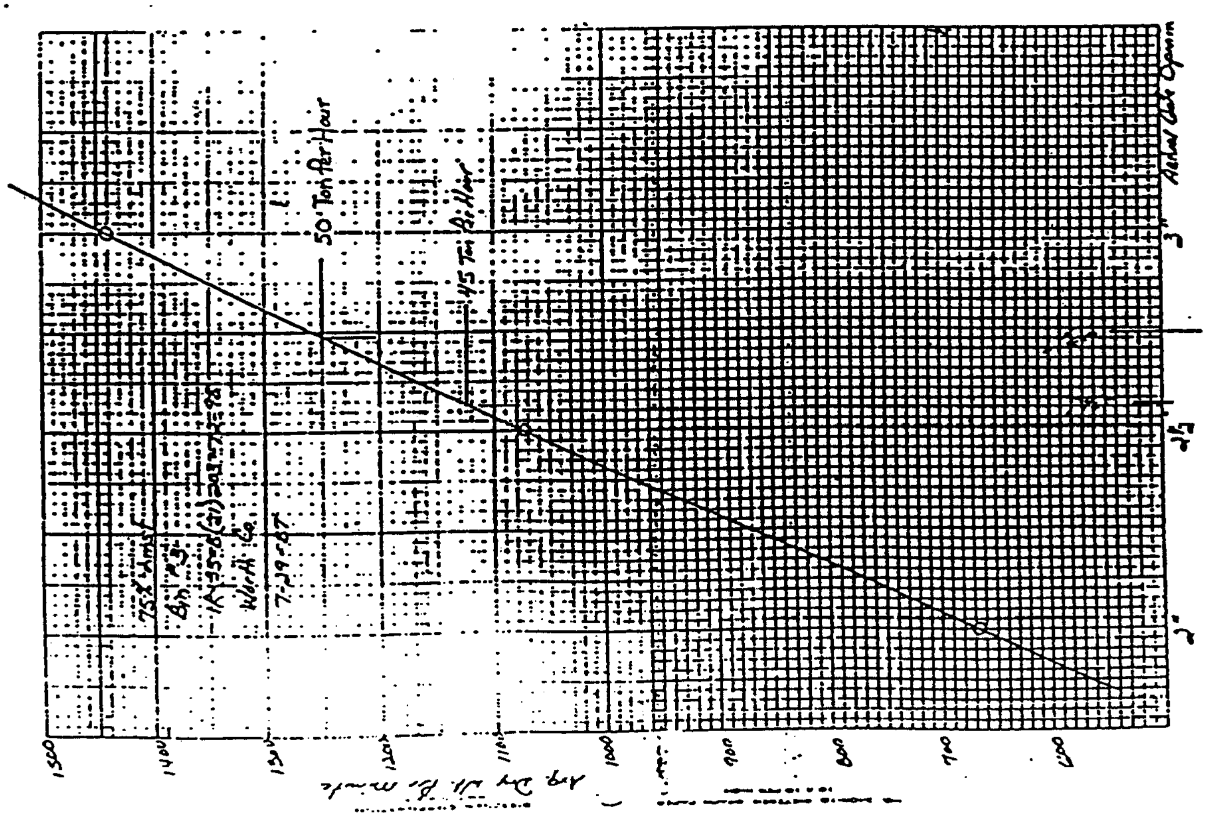
Calibrated by: [illegible] Witnessed by: [illegible]
Contractor: Tuttle Asphalt & Paving Inc. Title: A.C. Tech.

Distribution: White Copy - Plant Inspector; Canary Copy - Contractor; Pink Copy - District Materials Engineer; Goldenrod Copy - Project Engineer



Iowa Department of Transportation

CALIBRATION OF PLANT EQUIPMENT
Cold Feed and Asphalt Cement Delivery
(Continuous - Batch - Drum)

Project 1L-35-R(71)203--12-96
Contract No. 27371
Date 7-29-87
Proj. Eng. Summers

Contractor Little Asphalt Paving Plant Location Basic Matls - Ficklin Co. Material Ident. & % 25% Sand Moisture 5.40 %
Plant Type and Name B/G Cont. Pollution Control Scrubber Material Ident. & % ______ Moisture ______ %
Mix Type B Class ______ Mix Size 3/4" Gate ______ Material Ident. & % ______ Moisture ______ %
Asphalt Type and Grade AC-10 Temperature °F ______ RPM Feeder/RPM Plant/Meter 39.3 Plant Set for ______ TPH

Bin Number	1			1			1					
Pump vernier setting/gate opening in inches/Dial setting	1½"			2½"			3½"					
Run number	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	1	2	3	4	[illegible]	[illegible]
Revolutions delivered/Time delivered	184	167		149	152		97	97				
Total wet weight aggregate delivered/TPH wet	1140	1040		2160	2280		2160	2140				
Total weight A.C. delivered Total dry weight aggregate delivered/TPH Dry	1082	987		2049	2163		2049	2030				
Dry weight per revolution	5.88	5.91		13.75	14.23		21.13	20.93				
Dry weight per minute	166	167		389	403		598	592				
Average dry weight per (Minute-Rev.)/Tach set point	166.5			396			595					

Date scale was certified May 13 87

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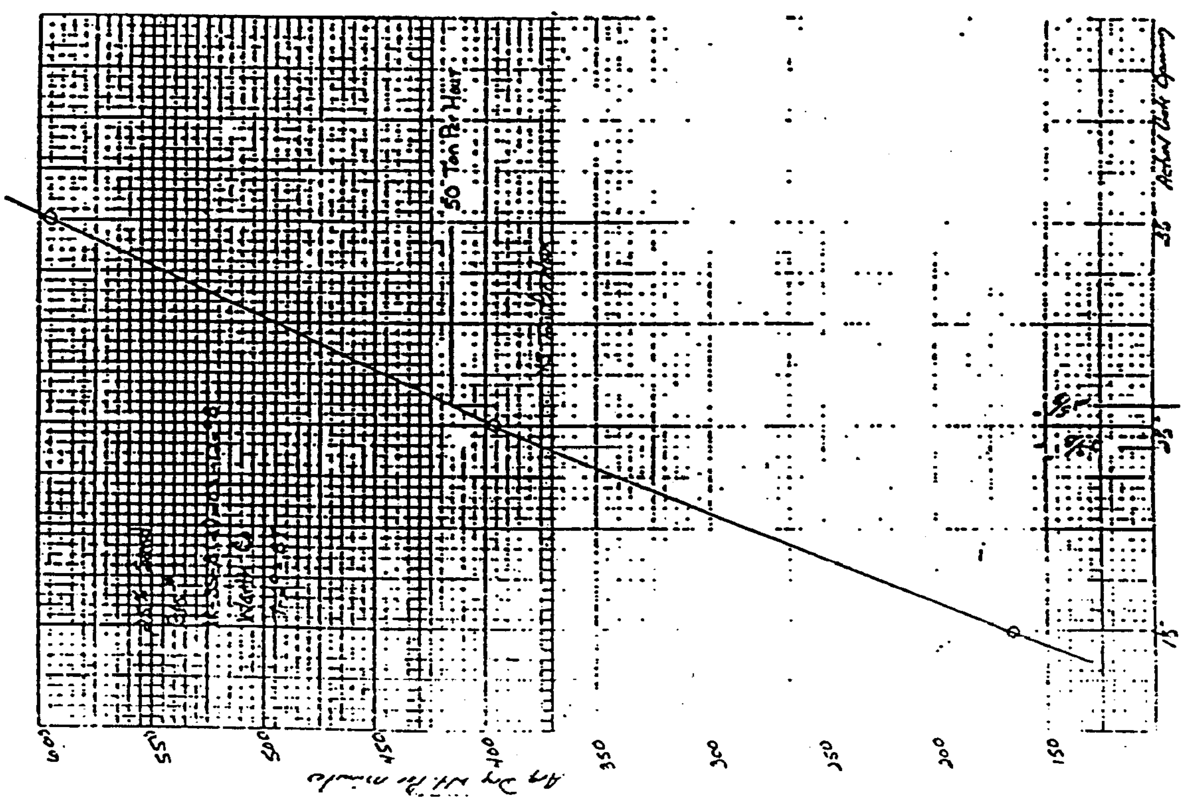
Calibrated by [illegible] Witnessed by [illegible]
Contractor Little Asphalt & Paving Inc. Title A.C. Tech

Distribution: White Copy - Plant Inspector; Canary Copy - Contractor; Pink Copy - District Materials Engineer; Goldenrod Copy - Project Engineer



INITIAL PLANT SETTING

TYPICAL PLANT COLD-FEED SETTINGS

The following example is based on initial plant output of 63,500 kg/hr (70 TPH) of mix. (Forms and graphs are on pages 22-23.)

Set for 63,500 kg/hr. (70 TPH) total cold-feed aggregate (Dry Weight):

$$\frac{70\text{ TPH x }2000\text{ lbs./ton}}{60\text{ min./hr.}} = 2333\text{ lbs./min. of mix}$$

$$\frac{63{,}500\text{ kg/hr.}}{60\text{ min./hr.}} = 1{,}058\text{ kg/min. of mix}$$

Material	% in Mix	kg/min.	(lbs./min.)	Gate Setting
12.5 mm (½ in.) Cr. Stone	60%	635	1400	Approx. 3⅝ (graph, page 22)
Sand	40%	423	933	Approx. 2⅛ (graph, page 23)

DRUM MIXING PLANT

The following example is based on initial plant output of 272,160 kg/hr. (300 TPH). (Form is on page 19.)

Set aggregate delivery controls on plant control console to deliver 272,160 kg/hr. (300 tons per hour) of dry aggregate.

Master control set on maximum.

kg/hr or TPH		kg/hr	or TPH
272,160 or (300) x 58% ¾ inch crushed limestone	=	157,853	174
272,160 or (300) x 30% Sand	=	81,648	90
272,160 or (300) x 12% RAP	=	32,659	36
100%		272,160	300

BATCH PLANT

INITIAL PLANT SETTING

After the aggregate scale and asphalt scale has been checked for accuracy, the batch weights are set and mixing operations are begun. The scales are checked by adding weights to the hopper and observing the scale dial indicators (form on page 21). Some batch plants are equipped with volumetric asphalt pumps rather than scale buckets; these devices are calibrated the same way that asphalt pumps are calibrated on continuous plants, but operated on a batch basis:

Assume 1,361 kg (3000 lb.) batch plant, cold-feeds as cited previously and 5.5% AC content.

SCALE SETTING

Asphalt: 5.5% AC x 1,361 kg (3000 lbs.) = 75 kg (165 lbs.) per batch (graph page 21)

Combined Hot Aggr: 1,361 kg (3000 lbs.) - 75 kg (165 lbs.) = 1,287 kg (2835 lbs.) per batch

Asphalt pump (volumetric) = 75 kg (165 lbs.) per batch = 23 counts per batch (graph page 22)

CONTINUOUS PLANT

HOT-FEED AND AC PUMP CALCULATIONS AND SETTINGS

Sprocket Drive AC Pump (based on a 5.10% AC content)

Assume asphalt pump calibrated with 34T x 35T sprockets and delivers 3.61 kg (7.95 lbs.) AC/Rev. (Calibration is on page 25.)

Assume RPM Plant = 11.0

Metric Calculations:

$$\frac{3.61\ \text{kg AC/Rev}}{5.10\%\ \text{AC}} = \frac{3.61}{0.05} = 70.78\ \text{kg mix/Rev}$$

70.87 kg mix/Rev x 11.0 RPM x 60 min/hr = 46,715 kg/hr mix

3.61 kg AC/Rev x 11.0 RPM x 60 min/hr = 2,383 kg/hr AC

67.17 kg Hot Aggr./Rev x 11.0 RPM x 60 min/hr = 44,332 kg/hr

Hot Aggregate Gate = 44,332 kg/hr → 247 mm ≈ 9 ¾ in.

Calculation using conventional units:

$$\frac{7.95\text{ lbs. AC/Rev}}{5.10\%\text{ AC}} = \frac{7.95}{0.051} = 155.88\text{ lbs. mix/Rev}$$

$$155.88\text{ lbs. Mix/Rev x } 11.0\text{ RPM x } \frac{60\text{ min./hr.}}{2000\text{ lbs./ton}} = 51.44\text{ TPH Mix}$$

$$7.95\text{ lbs. AC/Rev x } 11.0\text{ RPM x } \frac{60\text{ min./hr.}}{2000\text{ lbs./ton}} = 2.62\text{ TPH AC}$$

$$147.93\text{ lbs. Hot Aggr/Rev x } 11.0\text{ RPM x } \frac{60\text{ min./hr.}}{2000\text{ lbs./ton}} = 48.82\text{ TPH (Graph is on page 25.)}$$

Hot Aggregate Gate = 48.82 Ton/Hour = 9 ¾ in. (Graph is on page 25.)

(**NOTE:** The form for the above calculations is on page 25.)

If the dust is returned directly to the hot aggregate, separate computations are not required for the dust being fed since it is automatically included in the hot aggregate delivery.

All gate and scale settings and weighing controls shall be set to target on the required quantities. Offsetting shall not be permitted, except to correct calibration errors.

F. Production Inspection Duties

1. Temperature Control

It is necessary to observe and control the temperature of the various material components to document specification compliance, to prevent damage to the material, and to produce uniform workable mixtures. The specifications contain the ranges and tolerances for each type and class of mixture. It has been found that base mixtures which are to be placed in thick lifts can be produced at 115°C (240°F), where as fine mix surface courses must be produced at, or above 150°C (300°F). The specification limits for mix temperature are the same for all plant types. Production above or below these limits must be approved in advance by the Engineer, and documented as set out in Section 1108.04 of the Standard Specifications.

Point of Test (Temperature)

• Asphalt Cement	Delivery units and storage tanks
• Aggregate	Dryer Pyrometer

- Final Mixture — Truck body at plant
- Final Mixture (on road) — Behind Paver

2. Gradation Control

a. Cold-feed Gradation Control

The contractor is responsible for ensuring the gradation of the final mixture consistently complies with the requirements of the job mix formula. Cold-feed proportioning will be monitored and verified as part of the overall plant inspection activity. The final acceptance gradation will be based on the cold-feed gradation.

Advisory sampling and testing will be performed at the aggregate sources and after cold-feed combination at the plant site. Cold-feed check samples will be taken daily to verify the accuracy of proportioning and to provide guidance to the contractor with regard to mixture gradation. Addition quality tests above the minimum specified may be run at the option of the Transportation Center Materials Engineer.

The sampling and testing frequencies are outlined in Materials. I.M.204. Samples must be secured in a safe and reliable manner as provided In Section 1108 and 2001 of the Standard Specifications. Testing procedures shall be in accordance with I.M. Series 300.

The samples are to be obtained by incrementally cutting the stream or belt flow of combined aggregate feeding the drier. The contractor is responsible for furnishing a plant set-up that allows representative samples to be obtained. This may require equipment modification.

b. Non-compliant cold-feed gradation and other production mix irregularities may result from the following causes:

- Sample not representative of lot (Multiple hot bins)
- Improper bin balance
- Test errors, weights, calculations, etc.
- Incorrect cold-feed settings
- Non-uniform cold-feed delivery
- Stockpile segregation
- Stockpile contamination
- Storage bin segregation
- Intermingling of aggregates in stockpiles and/or feeders
- Wet, non-uniform stockpiles
- Degradation

When the cold-feed sieve analysis test indicates the combined material does not comply with the gradation requirements, the plant inspector shall take the following steps:

1. Recheck test procedures and computations.
2. Check gate settings and feeder operations.
3. Check the materials and material handling procedures.
4. Notify the Resident Construction Engineer, the Transportation Center Materials Engineer and the contractor of the results.
5. Obtain a second sample and test promptly.

If the cold-feed tests and/or inspection observations indicate that proportioning irregularities are occurring, the contractor is required to take corrective action immediately. Adjustments in proportions and other job mix formula changes must be approved, and documented in writing, in accordance with I.M. 511.

Several alternatives are normally available to the contractor when difficulties are encountered:

- Change material handling procedures.
- Correct proportioning.
- Change proportions. (Job Mix Formula irregularities change.)
- Waste fines collected by dust.
- Change materials. (New Job Mix Formula collection systems required.)
- Reset Job Mix Formula target.
- Change processing procedures at gradation source.

In most cases, operations will not be interrupted more than a few hours. If a change is made affecting the materials or proportions, a mix sample should be rushed to the laboratory for density-void analysis. Major proportion changes and source changes normally require laboratory analyses; these tests must be performed before a new job mix formula can be approved and used. All changes must be documented and reported immediately. Changes in materials or proportions are to be reported on Form #908. Because the cold-feed gradation is the basis for acceptance, the filler/bitumen ratio will be based on the cold-feed gradations.

3. Asphalt Content Control (Also refer to Materials I.M. 509.)

   The control of this material component is the most important plant inspection responsibility because the performance of the finished pavement is directly related to the quantity of binder incorporated in the mix. Separate check systems are used for continuous and batch plants as follows:

   a. Continuous and Drum Mixing Type Plants

During the first day or two of operations, and during periods when asphalt or aggregate delivery is questionable, it is advisable to perform proportioning validation in addition to the measurements required in I.M. 204. The specifications require drum-mixing plants to be equipped with totalizing asphalt meters and aggregate scales. Continuous plants have revolution counters and calibration data that gives kg (pounds) per revolution.

This equipment and information should be utilized for making continuous checks. Total asphalt delivered as indicated by the meter (or calculated from revolution counter and calibration data) should be periodically compared with quantities used as determined by tank measurements.

Validation Methods:

(1) Compare asphalt delivered by metering pump or scale with outage shown by 2 or 4 hour tank measurement (compare by kg (pounds), liters (gallons), or percent).

(2) Compare total mix produced, including waste, to asphalt and aggregate delivered by plant for a given period of time or number of plant revolutions.

b. Batch Type Plants

The operation of batch type plants should also be verified when work begins on a project. This is done by making intermediate tank measurements at 2-or 4-hour intervals and by checking the operation and sensitivity of the scale equipment.

If the measurements indicate that uniform control is not being maintained, the contractor is required by the specifications to adjust and correct his operations to obtain specification compliance. Such actions may include but not be limited to cleaning, repair, or replacement of equipment, recalibration of pumps and feeders, and training of personnel. In some cases it may be necessary for the contractor to obtain assistance from equipment manufacturers or distributors. Refer to the checklist on pages 35-36 for possible causes of difficulty.

The inspectors should be aware of the fact that the specifications provide for establishing mutual agreements for determining asphalt quantities on projects involving small quantities, or intermittent or diversified operations.

The illustration on page 36 shows how a control chart may bused to monitor asphalt content control and detect operating trends. The chart is a plot of the difference between the intended asphalt content and the actual as determined by tank measurements. Charts of this type are recommended for all projects and are particularly significant when continuous plants are employed.

PLANT INSPECTION ASPHALT CONTROL LIST

A. Before Calibration

1. Check capacity of storage tanks.
2. Check tank sticks.
    a. Be sure they fit the tanks.
    b. Determine proper use. (touch stick or dipstick, percent of diameter or inches, etc.)
    c. Be sure tanks are level.
3. Check piping and type of pumping system.
4. Learn the contractor method of operating the system.
5. Check the truck scales.

B. During Operation

1. Determine percent AC by tank stick measurement method as required.
2. Determine percent AC by verification as required.
3. Check batch scales for sensitivity.
4. Check truck scales for sensitivity.

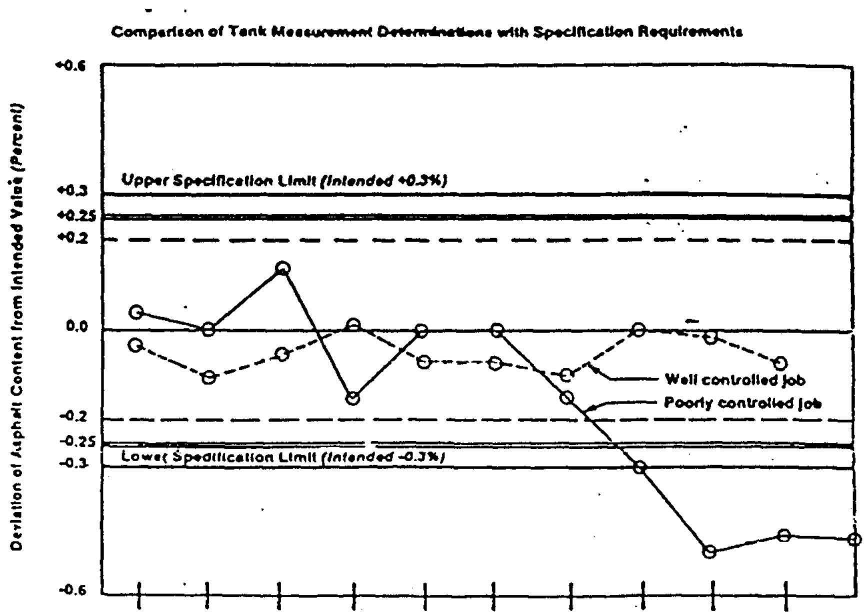
C. If Computed Percent AC is High:

1. Check tank stick readings and computations.
2. Check to be sure that all mix produced was included in the computations.
3. Check for spilled, wasted, or otherwise used asphalt cement.
4. Check to be sure all asphalt listed as **added** during the period should be included.
5. Check truck scales and total mix made.
6. Check hot-feeder gates and pump setting.
7. Check aggregate delivery level for uniformity.

D. If Computed Percent AC is Low:

1. Check tank stick readings and computations.
2. Check total mix made.
3. Check to be sure that all asphalt added during the period is included.
4. Check hot-feeder gate and pump setting.
5. Check for plugged nozzle.
6. Check pumping pressures.
7. Check strainer screen.
8. Check truck scales.

Materials I.M. 509 provides the detail procedure for making tank measurements and determining asphalt content.



E. Checking Scales

1. Batch Scales

Batch scale sensitivity shall be checked once per day during a normal working day by placing a weight equal to 1/10 percent of the batch weight on the fully loaded scales and observing the movement of the indicator. A properly sensitive scale will exhibit a visible indicator movement when so tested. If no indicator movement is visible, immediate corrective action must be taken by the contractor.

The specified scale delivery tolerance limits should be checked by periodically witnessing the batch weighing operations. Each scale indicator should consistently indicate the required weight within the specified delivery tolerance, and return to zero when unloaded within the specified 0.5 percent tolerance.

When automatic batch weighing equipment is used, the interlock system shall be set at the 1.0 percent limit as specified. They may be manually overridden to continue plant operation if the specified delivery tolerance is not exceeded. When the delivery tolerances are exceeded, the asphalt or aggregate batch sizes shall be adjusted manually to bring the batch into compliance, or it shall be wasted.

The plant superintendent or other authorized contractor representative must make all necessary scale and equipment settings and/or adjustments. Before the plant operation begins or resumes the plant inspector will independently determine for himself that the settings and/or adjustments are accurate and that the weights of material being delivered to the batch are correct.

Normal plant operation causes vibration, which tends to change these adjustments. Accumulation of material clinging to the inside of the weighing hopper can also cause these adjustments to drift. If the amount exceeds one percent of the material batch weight it must be removed and the empty weight readjusted to indicate a zero load.

2. Truck Scales

Truck scales shall be checked as provided in the Construction Manual, Section 3.50.

F. Specification Compliance

All materials shall be inspected prior to being incorporated in a pavement structure. Some materials are being shipped to projects under certification programs and others must have a report. In either case it is necessary to check and file the reports or certifications such that each final product component is properly identified and incorporated with the proper documentation. This is accomplished by obtaining the documents for each lot of material before incorporation. All shipments of all materials incorporated shall be logged as they are received.

A Non-compliance Notice (Form #225) shall be immediately delivered to the acting representative of the contractor for the area of construction involved whenever tests results on acceptance samples representing material to be incorporated or incorporated in the work indicate noncompliance with the specifications and plans. Appropriate action in accordance with the applicable specifications and Instructional Memorandums shall be taken.

G. Sampling and Testing

The plant inspector is responsible for securing all job control samples, performing process control gradation tests and tank stick measurements. The plant inspector is also responsible for calculating the percent laboratory density, percent voids, percent asphalt, Quality Index, and reporting the results. The specifications and Materials I.M. 204 establish the requirements and minimum frequencies for each type of material and construction. Density and gradation testing are to be given prompt and careful attention and the contractors and Resident Engineer are to be kept advised at all times. The Construction Manual provides instructions and examples pertaining to documentation requirements.

On projects that require Certified Plant Inspection without QM-A, it is the plant monitor's responsibility to identify random core locations, observe core cutting, transport cores to the field laboratory, determine and record core densities, and quality index.

On Quality Management (QM-A) projects, the contractor QMA Laboratory Technician is responsible for meeting all sampling, testing, and documentation requirements as set forth by the current QMA Specification (Section 1201).

When granular base courses, sub-bases and soils are being compacted to a specified level of density, the laboratory density, Standard Proctor or Modified Proctor will be determined in the field. Representative samples should be obtained as early as possible so that immediate evaluations can be made of the contractor compaction procedure.

1. Lot Sampling

   a. Aggregate gradation testing, sampling and evaluation. For construction operations that are carried on continuously, a **lot** is defined as a day's run or major portion of a day's run. Intermittent construction operations involving small quantities shall be grouped to establish a lot; the time period shall normally not be longer than one week or working days.

   b. Density Samples

      For explanation and definition of **lots**, see Section 2303.12 of the Standard Specifications.

      Laboratory density of hot asphalt mixtures, due to equipment limitations and requirements can only be determined by the Central Laboratory, and the Transportation Center Laboratories. The first daily hot mix and cold-feed samples are to be delivered immediately after they are taken; no delays will be tolerated. If the contractor is responsible for the delivery of samples, the contractor is to make provisions to have the personnel and vehicle available to accomplish immediate delivery. Hot mix samples are to be obtained in accordance with I.M. 322 on all types of work.

H. Calculation of Percent of Laboratory Density

The core density, expressed as percent of laboratory density, is calculated as follows:

$$\text{percent lab. density} = \frac{(\text{core density})(100)}{\text{lab. density}}$$

I. Calculation of Percent Voids

The percent voids in the sample is calculated as follows:

$$\text{percent voids} = 100 - \frac{100(\text{sample density})}{\text{maximum density}}$$

NOTE: Rice, maximum density, and solid density are synonymous.

J. Calculating average % voids for a lot.

1. $$\text{Average field density of the lot} = \frac{\text{Sum of field densities}}{\text{Number of Samples}}$$

2. $$\text{Average \% Voids} = 100 - \frac{100(\text{average field density})}{\text{maximum density}}$$

EXAMPLE:

Given: lab. density 2.408

Given: maximum density 2.461

Given: field densities of individual cores: 2.319, 2.316, 2.310, 2.298, 2.269, 2.340, and 2.345.

$$\text{Average field density of the lot} = \frac{2.319 + 2.316 + 2.310 + 2.298 + 2.269 + 2.340 + 2.345 + 2.314}{7}$$

$$\text{Average \% voids} = 100 - \frac{100(2.314)}{2.461} = 6.0\%$$

K. Calculation of Quality Index for density

The Quality Index for density shall be determined according to the following calculation:

$$\text{QI(density)} = \frac{\text{sample avg. density \% - specified density \%}}{\text{standard deviation density \%}}$$

The formula for standard deviation density % is:

$$\sigma\ n-1 = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$$

Where:
$\sigma\, n-1 =$ standard deviation
x = individual sample density %
$\bar{x} =$ Sample average density %
n = number of samples

EXAMPLE QI CALCULATION:

Using the same data from the example in Item 9 above:

Lab Density is 2.408.

Field Densities of individual cores are 2.319, 2.316, 2.310, 2.298, 2.269, 2.340, and 2.345.

Note: Average % of lab density of each core is determined as under #7 above.

EXAMPLE:

$$\text{\% lab density} = \frac{2.319}{2.408}(100) = 96.304$$

$$\text{Average \% lab density} = \frac{96.304 + 96.179 + 95.930 + 95.432 + \text{etc.}}{7} = 96.090$$

The tabular format below can be used to calculate $(x - \bar{x})^2$ for the std. dev. calculation.

x	$\bar{x}$	$(x - \bar{x})$	$(x - \bar{x})^2$
96.304	96.090	0.214	0.046
96.179	96.090	0.089	0.008
95.930	96.090	-0.160	0.026
95.432	96.090	-0.658	0.433
94.228	96.090	-1.862	3.467
97.176	96.090	1.086	1.179
97.384	96.090	1.294	1.674
		TOTAL	6.833

STANDARD DEVIATION DENSITY % = ó n-1 = $\sqrt{\frac{6.833}{7-1}}$

ó n-1 = 1.067

NOTE: In lieu of the manual calculations demonstrated in this example, an electronic calculator with an (n-1) standard deviation capability may be used for the standard deviation density % determination.

Calculate Quality Index to two decimal places.

$$\text{QI (density)} = \frac{96.090 - 95.000}{1.067} = 1.02$$

L. QI (density) test procedure for outlying test results

An outlying observation, or **outlier**, is one that deviates markedly from other members of the sample set in which it occurs. Test results proven to be outliers by the test shown below shall not be included and a failing QI recalculated. Only one outlier may be considered per set of densities representing an individual lot. Outliers will only be considered for QI numbers that results in price adjustment.

Outliers will not be considered if, their use, results in an increase of an existing price adjustment.

To test for a suspected outlier result, apply the appropriate formula. (See below.)

Formula for suspected outlier:

$$\text{Suspected high outliers} = \frac{\text{highest density \% - average density \%}}{\text{standard deviation density \%}}$$

$$\text{Suspected low outlier} = \frac{\text{average density \% - lowest density \%}}{\text{standard deviation density \%}}$$

The highest density or lowest density shall not be included if the suspected outlier result is more than 1.80 for seven samples. The quality index shall then be recalculated for the remaining six samples. If the QI is then 0.73 or more for the remaining six samples, the contractor will receive 100 percent pay.

Example is for a low outlier. The same procedure is used with the appropriate formula to determine a high outlier.

Lab density = 2.408

Specified density = 95.000%

Densities	%Densities(x)	Avg.($\bar{x}$)	($x - \bar{x}$)	$(x - \bar{x})^2$
2.319	96.304	95.930	0.374	0.140
2.316	96.179	95.930	0.249	0.062
2.310	95.930	95.930	0.000	0.000
2.298	95.432	95.930	-0.498	0.248
2.242	93.106	95.930	-2.824	7.975
2.340	97.176	95.930	1.246	1.553
2.345	97.384	95.930	1.454	2.114
AVG.	95.930		TOTAL	12.092

ó n-1 = $\sqrt{\dfrac{12.092}{7-1}}$ = 1.420

$$QI = \frac{95.930 - 95.000}{1.420} = 0.65$$

The QI of 0.65 is less than 0.73, and therefore results in 95 percent payment. The low density of 93.106 is suspected to be a low outlier.

Test result for suspected low outlier =

$$\frac{95.930 - 93.106}{1.420} = \frac{2.824}{1.420} = 1.989$$

This result is greater than 1.80 for seven samples, therefore the core with the lowest percent of density, 93.106, is an outlier.

Recalculate the QI for the remaining six densities (excluding the outlier).

Densities	% Densities(x)	New Avg.($\bar{x}$)	($x - \bar{x}$)	$(x - \bar{x})^2$
2.319	96.304	96.401	-0.097	0.009
2.316	96.179	96.401	-0.222	0.049
2.310	95.930	96.401	-0.471	0.222
2.298	95.432	96.401	-0.969	0.939
2.340	97.176	96.401	0.775	0.601
2.345	97.384	96.401	0.983	0.966
AVG.	96.401		TOTAL	2.786

ó n-1 = $\sqrt{\dfrac{2.786}{6-1}}$ = 0.746

$$\text{new QI} = \frac{96.401 - 9500}{0.746} = 1.88$$

The new QI is greater than 0.73 for six or seven samples so the contractor will receive 100 percent payment.

M. Determining gradation on recycle projects:

The average RAP gradation available with the "target % of R.A.P." will be combined mathematically with the daily virgin aggregate cold-feed gradation and target % of virgin aggregates to determine the daily mix control and acceptance gradation.

The following calculations should be used to determine the final recycled AC cold-feed gradation.

1. $$\%\,\text{RAP(aggr.)} = \frac{(\%\text{RAP})[1.00 - (\%\text{RAP AC} \div 100)]}{\%\text{ virgin aggr.} + (\%\text{RAP})[1.00 - (\%\text{RAP AC} \div 100)]}(100)$$

Example: Assume; 25% RAP containing 5% AC, 75% virgin aggregates

$$\%\text{RAP(aggr.)} = \frac{(25.0)(1.00 - 0.05)}{75.0 + (25.0)(1.00 - 0.05)}(100) = \frac{23.75}{98.75}(100) = 24.05\%$$

2.

$$(\text{Actual})\,\%\text{ virgin aggr.} = \frac{(\text{Assumed})\,\%\text{ virgin aggr.}}{(\text{Assumed})\,\%\text{ virgin aggr.} + (\%\text{RAP})[1.00 - \%\text{RAP AC} \div 100)]}(100)$$

Example: $$\frac{75.0}{75.0 + (25.0)(1.00 - 0.05)}(100) = 75.95\%$$

NOTE: Use either formula 1 or 2 and subtract the result from 100 to get the other % of aggregate.

3. Calculating the percent RAP gradations and the percent virgin gradation on each screen to total the composite gradation.

% RAP grad. = (%RAP aggr.)(RAP grad. % passing)(as found on form 955)

% virgin cold-feed grad. = (actual % virgin aggr.)(virgin cold-feed grad. % passing)

Composite gradation = Calculated % RAP gradation + Calculated % cold-feed grad.

NOTE: RAP gradation % passing is found on the Form #955.

EXAMPLE:	19 (3/4)	12.5 (1/2)	9.5 (3/8)	4.75 (4)	2.36 (8)	1.18 (16)	600 (30)	300 (50)	150 (100)	75 (200)
a) RAP Gradation	100	99	93	69	51	40	33	21	14	11
b) Daily Cold-feed Gradation	100	99	90	72	59	47	32	16	8.7	5.5

% of RAP aggregate, same as above **24.05**
% of actual virgin aggregate, same as above 75.95

EXAMPLE:	19 (3/4)	12.5 (1/2)	9.15 (3/8)	4.75 (4)	2.36 (8)	1.18 (16)	600 (30)	300 (50)	150 (100)	75 (200)
% passing line a x **24.05**	24.1	23.8	22.4	16.6	12.3	9.6	7.9	5.1	3.4	2.6
% passing line b x 75.95	76.0	75.2	68.3	54.7	44.8	35.7	24.3	12.2	6.6	4.2
Composite Gradation	100	99.0	90.7	71.3	57.1	45.3	32.2	17.3	10.0	6.8

N. Determination of AC to be added (Tank Stick) to recycled mix.

$$\text{\% AC (added)(Tank stick)} = \frac{100(\text{Total intended \% AC}) - (\text{\%RAP})(\text{\% AC in RAP})}{100 - (\text{\%RAP})(\text{\% AC in RAP} \div 100)}$$

<u>Example:</u> 25% RAP containing 5% AC; total AC in recycled AC mix, 6.25%

$$\text{\% AC (added)(Tank stick)} = \frac{100(6.25) - (25)(5)}{100 - (25)(5 \div 100)} = \frac{500}{98.75} = 5.06\%$$

Determination of total intended AC in a recycled mix. If % RAP, % A.C in RAP, and % AC to be added are known, then total intended % A.C in the mix can be calculated.

Total % AC = % AC add + % RAP (% AC in RAP)(.01)
- (% AC add)(% RAP)(% AC in RAP)(.0001)

Example: 25% RAP containing 5% AC; total % AC added (Tank Stick), 5.06%

Total % AC = 5.06 + (25)(5)(.01) - 5.06(25)(5)(.0001) = 6.31 - 0.06325 = 6.25%

O. Completed Project

When a project is completed, the plant inspector should again check all records and documentation for accuracy and completeness. It is also necessary to determine at this time the net quantity of materials incorporated in the project. The field records and plant records should be compared and final determinations made. Detailed instructions are provided in the Construction Procedures and Inspection Manual.

P. Diary and Report Requirements

1. Diary, refer to the Construction Manual.

2. Report Forms. Two forms are used to document plant operations and provide sample identification. They are:

Form #E241, #M241 Daily Plant Page. This form is submitted daily to document plant operations, job control testing, and material placement on all hot mix and cold mix construction. See Appendix C for instructions on completing the form and examples.

Form #193 Identification of Sample for Test. This form must accompany all samples submitted to the Central Laboratory and Transportation Center Laboratories. Examples of completed forms have been included in this instruction.

3. Testing Worksheets. All worksheets and other original documents used by inspection personnel are to include identification of: 1. individuals associated with sampling and testing, 2. County and Project No., 3. Material and sampling point, 4. date and time of sampling and testing and, 5. source, producer or contractor. All documents other than field notebooks are to be filed with the appropriate report and retained per the file retention schedule.

Refer to the Construction Manual.

4. Control Sheets. For any mixture that exceeds 14 Mg (15 tons) per project, control charts shall be used for the AC content, % passing 4.75 mm (No. 4) sieve, % passing 600 µm (No. 30) sieve, and % passing 75 µm (No. 200) sieve. These charts shall be maintained by the Certified Plant Inspector. They shall be maintained daily.

QMA projects require control charts for all mix production. In addition to the above noted control charts, on QMA projects, charts are also required for laboratory density, laboratory air voids, % passing the 4.75 mm (#4), 2.36 mm (#8), 600 µm (#30), and 75 µm (#200) sieves, and maximum specific gravity.

The control charts shall be similar to the format shown on page 36 of this I.M. (asphalt cement), and approved by the Department for use on QMA projects. At the end of the project, these charts shall be forwarded to the Transportation Center Materials Engineer.

Q. Mixture Segregation

In addition to determining if all of the required equipment is available, calibrated, and functioning properly, the plant inspector should monitor mixture uniformity for potential problems. One of the most troublesome difficulties encountered during production is mixture segregation, which may be caused by plant equipment or operation. Segregation at the plant may be caused by:

1. Pugmill discharge being too high above the truck bodies.

2. Depositing into very large truck bodies, causing the mixture to cone and roll. In this case trucks should be moved back and forth during loading.

3. Pugmill or storage gates opening improperly. They may not open or close quickly or to the full extent of the opening.

4. Inadequate mixing. This may be caused by short mixing cycle, improper mixer paddle positioning, worn paddles, or low level in the mixing chamber.

5. Improperly designed, maintained, and operated surge and storage bins and conveyors. Example - material discharge into conveyor must be centered into the bucket or belt.

6. Failure to provide near level truck charging platform.

Coarse, lean mixtures are more subject to segregation than fine-rich mixtures, therefore more care must be exercised when coarse mixtures are being produced. Segregation of the mix results in non-uniform distribution of the material in the pavement. This can lead to a patchy appearance as well as early structural distress.

R. Asphalt Cement Contamination

Another potential problem encountered during production is contamination of the asphalt cement. This may be caused by:

1. Allowing fuel oil used for cleaning pumps and lines to enter the storage tanks.

2. Accepting delivery of non-specification material or material of a different grade.

3. Leakage of plant heating oil into the storage tanks.

4. Contaminated delivery tanks.

5. Improper sampling, and sample catching container, refer to I.M. 323.

Alert inspection and proper supervision can prevent contamination by the contractor since most of the problems are associated with the use of cleaning fluids and improper material combination.

Form 830163
3-88

Central Lab No. ____________

Iowa Department of Transportation
Highway Division, Office of Materials, Ames, Iowa

IDENTIFICATION OF SAMPLE FOR TEST

(Read instructions on back before taking sample and filling out form)

Material: Type "A" Asphalt Conc. 3/8" Mix 5.75% AC — Sender's Sample No.: 4

Intended Use: Surface course — Contract Number: ____

County: Wapello — Project: FN-34-4(6)--51-90 — Road No.: US 34

Group No.: ____ — Design No.: ABD9--0040 — Specification No.: STD.

Contractor: Norris Construction Co. (Name) — Ottumwa, Iowa (Address)

Producer: ____ — Brand: ____

Location of PAVING Plant: Johnson Quarry 1 mile N. of Podunk Center

____ Sec. ____ Twp. ____ Range ____ Co. ____

Unit of Material Represented: 1--day's run 9-9-92

Quantity Represented: 1200 tons

Sample by: John Smith (Name) — Ottumwa, Iowa (Address)

Date Sampled: 9-9-92

Report to Districts (Check appropriate box(es)) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6

Report to Residency (Write appropriate residency number) ☐☐ ☐☐ ☐☐ ☐☐ ☐☐

Report to Counties (Write appropriate county number) ☐☐ ☐☐ ☐☐ ☐☐ ☐☐

Report to Other ____ (Name) ____ (Title) ____ (Address) ____ (Phone)

Report to Other ____ (Name) ____ (Title) ____ (Address) ____ (Phone)

Results need by: Date ____

Additional Detailed Information:
(For paint give analysis printed on container. For tile give grade specified, etc.)

40 lb.. Mix Sample per Materials Dept. I.M. 204

Circle Sample Type	
AS	Assurance
PN	Project Information
MD	Mix Design
DI	Dept. Information
WH	Warehouse Stock
RP	Research Project

(NOTE: A representative of the Department of Transportation shall select the sample.)

Distribution: White copy - Central Materials; Yellow copy - File

Form 820183, 8-84

Iowa Department of Transportation

Highway Division, Office of Materials, Ames, Iowa

Central Lab No. ____________

IDENTIFICATION OF SAMPLE FOR TEST

(Read instructions on back before taking sample and filling out form)

Material: AC-10 Asphalt Cement Sender's Sample No.: 1

Intended Use: Type B Asphalt Concrete Surface Course Contract Number: ____________

County: O'Brien Project: FN-10-5(2) Road No.: IA 10

Group No.: ____________ Design or Mix No.: ____________ Specification No.: Std.

Contractor: Midwest Surfacing Co. (Name) Humboldt, Iowa (Address)

Producer: Amoco Oil Company Brand: ____________

Location of Producing Plant: Sugar Creek, Missouri

____________ Sec. ____________ Twp. ____________ Range ____________ Co. ____________

Unit of Material Represented: 10,000 gallons used on 10-1-88

Quantity Represented: 10,000 gallons

Sample by: Tom Brown (Name) Cherokee, Iowa (Address)

Date Sampled: 10-1-88

	Name	Title	Address	Phone
Report to	XXXXXXXX	Materials Engineer	Ames, Iowa	
Report to	XXXXXXXX	District Engineer	XXXXXXXX	
Report to	XXXXXXXX	Resident Engineer	XXXXXXXX	
Report to				
Report to				

Results need by: Date ____________

Additional Detailed Information:

(For paint give analysis printed on container. For tile give grade specified, etc.)

1-3 oz. sample per Matls. I.M.-204 for viscosity.

(NOTE: A representative of the Department of Transportation shall select the sample.)